UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

June 2, 2015

MEMORANDUM FOR: Leslie Craig
Southeast Region Supervisor, NOAA Restoration Center

FROM: Virginia M. Fay
Assistant Regional Administrator, Habitat Conservation Division

SUBJECT: Essential fish habitat review of the construction of the Restoring Living Shorelines and Reefs in Mississippi Estuaries project

In response to the Deepwater Horizon oil spill, NOAA and the other Trustee agencies propose to fund the construction of four miles of living shoreline breakwaters, five acres of intertidal reefs, and 267 acres of subtidal reef at a total of eight locations in coastal Mississippi. The approximate cost of construction is $30 million using Phase IV Early Restoration funds. The activities described in the EFH assessment would provide temporary short and long term minor impacts to water bottoms and water column categorized as essential fish habitat (EFH) under provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

As specified in the Magnuson-Stevens Act, EFH consultation is required for federal actions which may adversely affect EFH. The NOAA's Restoration Center prepared an EFH assessment for this project and provided the document for our review by electronic mail dated May 27, 2015. The Southeast Region's Habitat Conservation Division (SER HCD) has reviewed the EFH assessment and finds the document adequately evaluates potential project impacts to EFH supportive of a number of federally managed fishery species. While project implementation would temporarily impact water bottoms and water column supportive of a variety of federally managed fishery species, best management practices to minimize short term impacts have been developed and were included in the EFH assessment.. Additionally, SERO HCD believes the proposed work should enhance the fishery productivity of the project area and concurs with the statements in the EFH assessment that effects of project implementation are expected to be minor and would have no substantial impacts to EFH. Therefore, SER HCD has no EFH conservation recommendations to provide pursuant to Section 305(b)(2) of the Magnuson-Stevens Act at this time. Further consultation on this matter is not necessary unless future modifications are proposed and such actions may result in adverse impacts to EFH.

cc:
F/SER – Giordano
F/HCD – Schubert
F/SER4 – Dale
F/SER46 - Hartman

Essential Fish Habitat Assessment for the Restoring Living Shorelines and Reefs in Mississippi Estuaries Project

1.0 INTRODUCTION

The purpose of this document is to present the findings of the Essential Fish Habitat (EFH) assessment conducted for the proposed Restoring Living Shorelines and Reefs in Mississippi Estuaries project as required by the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended through 1996 (Magnuson-Stevens Act). The objectives of this EFH Assessment are to describe how the actions proposed by Restoring Living Shorelines and Reefs in Mississippi Estuaries project may affect EFH designated by the National Marine Fisheries Service (NMFS) and Gulf of Mexico Fisheries Management Council (GMFMC), for the area of proposed action. According to the GMFMC, EFH within the Gulf of Mexico (Gulf) includes all estuarine and marine waters and substrates from the shoreline to the seaward limit of the Exclusive Economic Zone (EEZ). The footprint of the "Restoring Living Shorelines and Reefs in Mississippi Estuaries" project is the area of proposed action (Figures 2 – 9). This assessment would include a description of the proposed action; a summary of EFH within the vicinity of the project site areas; a description of each Fishery Management Plan; an analysis of the direct, indirect and cumulative effects on EFH for the managed fish species and their major food sources; the effects of the proposed action; and proposed minimization measures selected to minimize expected project adverse effects.

2.0 PROJECT DESCRIPTION

The proposed project includes the restoration of secondary productivity through the placement of intertidal and subtidal reefs and protection of marsh habitat through the use of living shoreline techniques including breakwaters. Projects are proposed in Grand Bay, Graveline Bay, Back Bay of Biloxi and the vicinity, and St. Louis Bay in Jackson, Harrison, and Hancock Counties, Mississippi (Figure 1). The project builds on recent collaborative efforts by Mississippi Department of Marine Resources (MDMR), National Oceanic and Atmospheric Administration (NOAA), and The Nature Conservancy (TNC) restoration projects through the NOAA Community-based Restoration Program and other sources. The project would provide for construction of over 4 miles of breakwaters, 5 acres of intertidal reef habitat and 267 acres of subtidal reef habitat at eight (8) locations (Figure 1 and Table 1). Over time, the breakwaters, intertidal and subtidal restoration areas would develop into living reefs that support benthic secondary productivity, including, but not limited to, bivalve mollusks, annelid worms, shrimp, and crabs and would protect salt marsh habitat. The estimated cost for this project is $30,000,000.

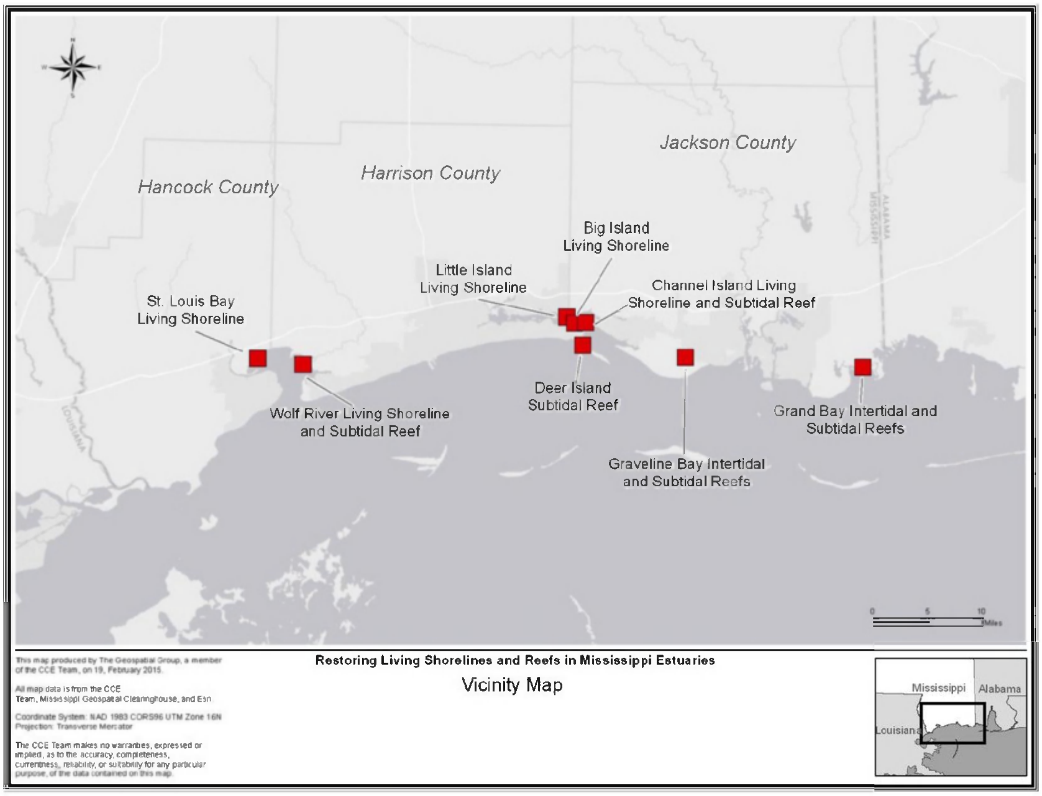

Figure 1: Restoring Living Shorelines and Reefs in Mississippi Estuaries-Vicinity Map Depicting Project Components

The project components are grouped into four project locations. The project components are located in Grand Bay, Graveline Bay, Back Bay of Biloxi, and St. Louis Bay. For this project, the living shoreline approach includes constructing breakwaters made of approved manufactured and/or natural materials that that reduce shoreline erosion by dampening wave energy while encouraging reestablishment of habitat that was once present in the region. Breakwaters would develop into reefs that support secondary productivity (living reefs). The sites were chosen based on the presence of documented shoreline erosion. Subtidal and intertidal reefs will be built using approved cultch material (e.g limestone, crushed concrete, oyster shell or a combination thereof). Some sites would be built to complement current restoration sites constructed by MDMR, NOAA, and The Nature Conservancy projects through the NOAA Community-based Restoration Program. The following proposed early restoration project components are listed in Table 1 (Figures 2-9) and described below:

Table 1. Restoring Living Shorelines and Reefs in Mississippi Estuaries-Project Components

Project Components	Breakwater Structure Length (feet)	Subtidal Reef Habitat (acres)	Intertidal Reef Habitat (acres)
Grand Bay and Graveline Bayou (Jackson County)			
Grand Bay Intertidal and Subtidal Reefs		77	3
Graveline Bay Intertidal and Subtidal Reefs		70	2

Table 1. Restoring Living Shorelines and Reefs in Mississippi Estuaries-Project Components

Project Components	Breakwater Structure Length (feet)	Subtidal Reef Habitat (acres)	Intertidal Reef Habitat (acres)
Back Bay of Biloxi and Vicinity (Jackson and Harrison County)			
Channel Island Living Shoreline and Subtidal Reefs	2,385	70	-
Big Island Living Shoreline	5,011	-	-
Little Island Living Shoreline	2,316	-	-
Deer Island Subtidal Reef	-	20	-
St. Louis Bay (Harrison and Hancock County)			
Wolf River Living Shoreline and Subtidal Reef	1,388	30	-
St. Louis Bay Living Shoreline	10,812	-	-
TOTAL	21,912 feet 4.1 miles	267 acres	5 acres

Grand Bay Project Components (Jackson County)

Grand Bay Intertidal and Subtidal Reefs (Figure 2): The Grand Bay Intertidal and Subtidal Reefs project components would restore approximately 3 acres of intertidal reefs in the intertidal waterways of Grand Bay. Approximately 77 acres of subtidal reef habitat would be restored in the nearshore environment of Grand Bay. Conceptual site locations for the intertidal and subtidal reefs are depicted in Figure 2 and are subject to refinement.

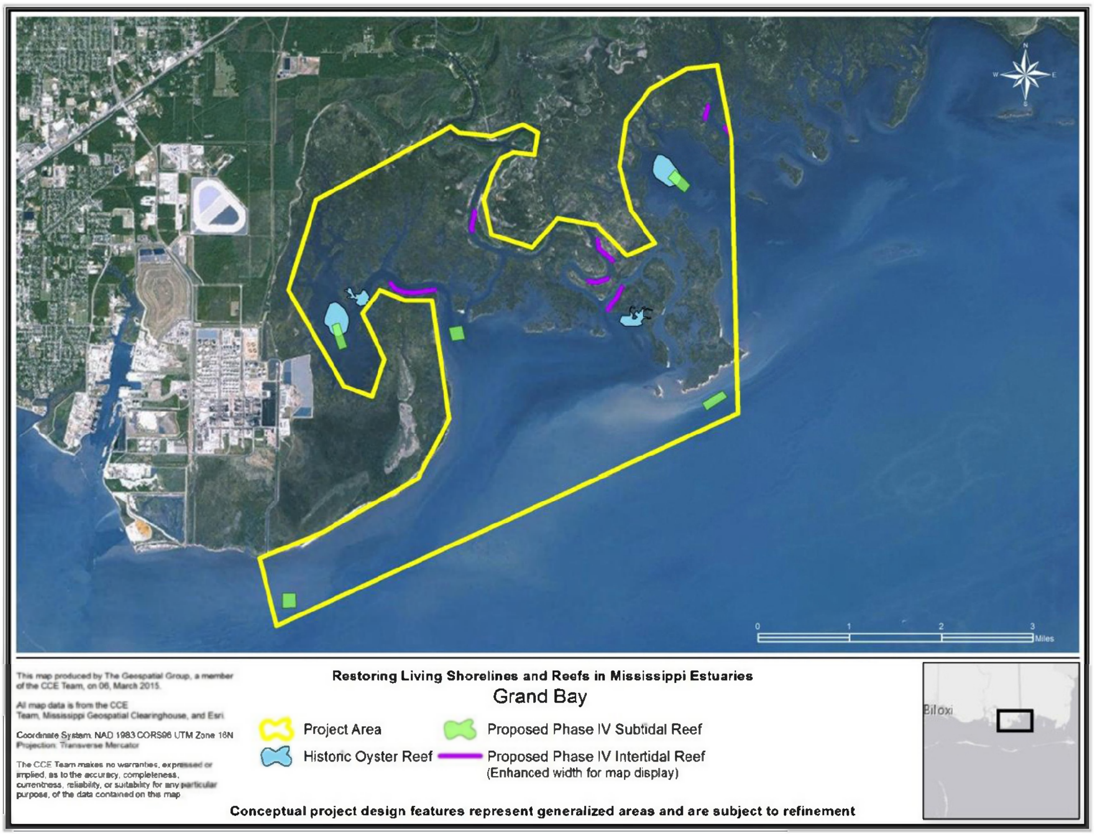

Figure 2: Grand Bay Intertidal and Subtidal Reefs Project Area

Graveline Bay Project Component (Jackson County)

Graveline Bay Intertidal and Subtidal Reefs (Figure 3): The Graveline Bay Intertidal and Subtidal Reefs project component would restore approximately 2 acres of intertidal reefs along the intertidal waterways of Graveline Bay. Approximately 70 acres of subtidal reef habitat would be restored in the nearshore environment of Graveline Bay. Conceptual site locations for the intertidal and subtidal reefs are depicted in Figure 3 and are subject to refinement.

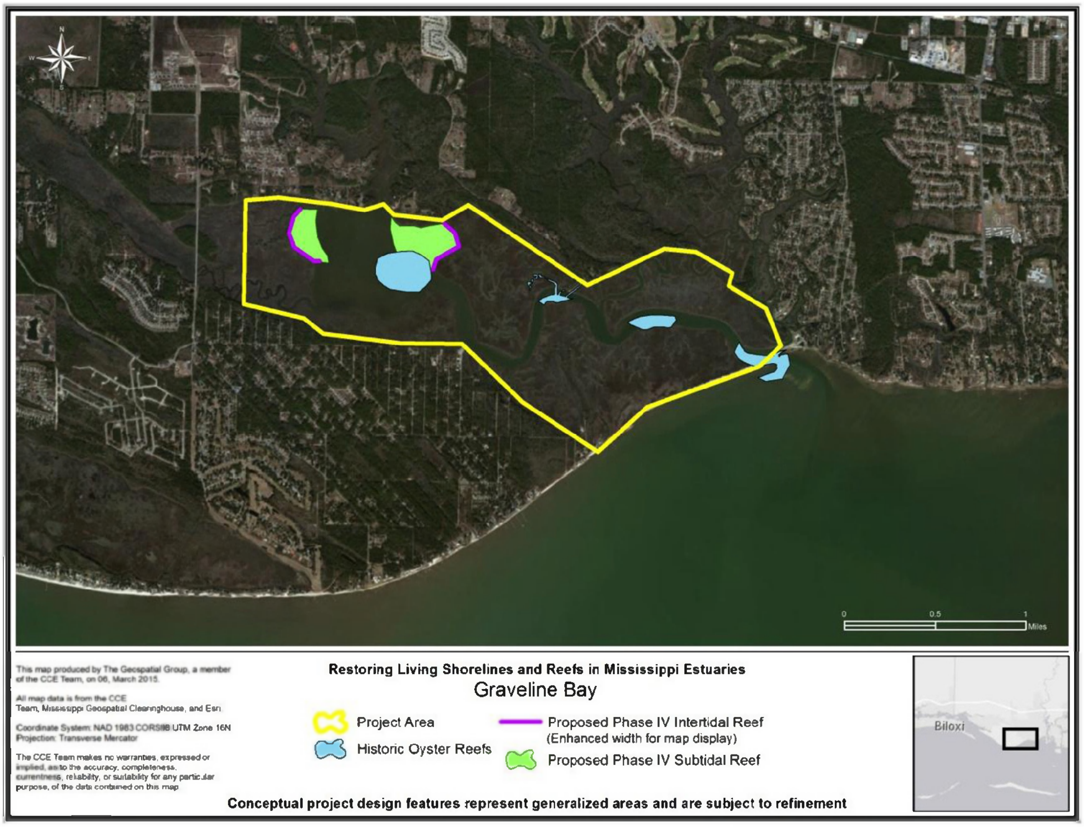

Figure 3: Graveline Bay Intertidal and Subtidal Reefs Project Area

Back Bay of Biloxi Project Components (Jackson and Harrison County)

Back Bay of Biloxi would have four project components located along islands within Back Bay of Biloxi, which currently experience erosion. Using living shoreline techniques, such as breakwater or intertidal shoreline stabilization, erosion rates would be reduced along approximately 1.8 miles of marsh island shoreline in Back Bay of Biloxi. Approximately 90 acres of subtidal reef habitat would be restored at locations in Back Bay of Biloxi and in the vicinity on the north side of Deer Island, adjacent to current reef projects.

<u>Channel Island Living Shoreline and Subtidal Reef (Figure 4)</u>: Would include construction of approximately 2,385 ft. of breakwater along the shoreline. Approximately 70 acres of subtidal reef habitat would be created and would connect the breakwater structure to an existing subtidal reef on the North and South sides of the island. The conceptual site location for the breakwater, subtidal reefs and temporary flotation channels are depicted in Figure 4 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

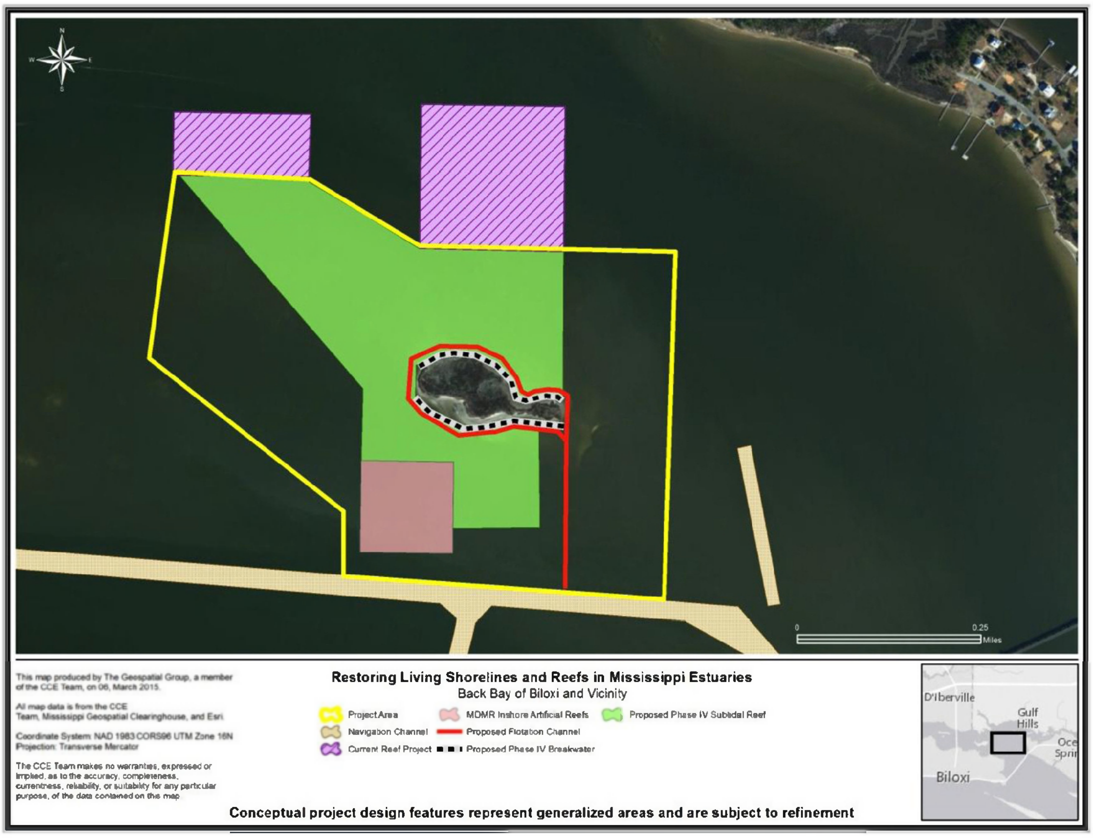

Figure 4: Channel Island Living Shoreline and Subtidal Reefs Project Area

<u>Big Island Living Shoreline (Figure 5)</u>: Would include construction of approximately 5,011 ft. of breakwater along the southern facing shoreline directly adjacent to the navigation channel. The conceptual site location for the breakwater and temporary flotation channels are depicted in Figure 5 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

Figure 5: Big Island Living Shoreline Project Area

Little Island Living Shoreline (Figure 6): Would include construction of approximately 2,316 linear ft. of breakwater along the southern facing shoreline directly adjacent to the navigation channel. The conceptual site location for the breakwater and temporary flotation channels are depicted in Figure 6 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

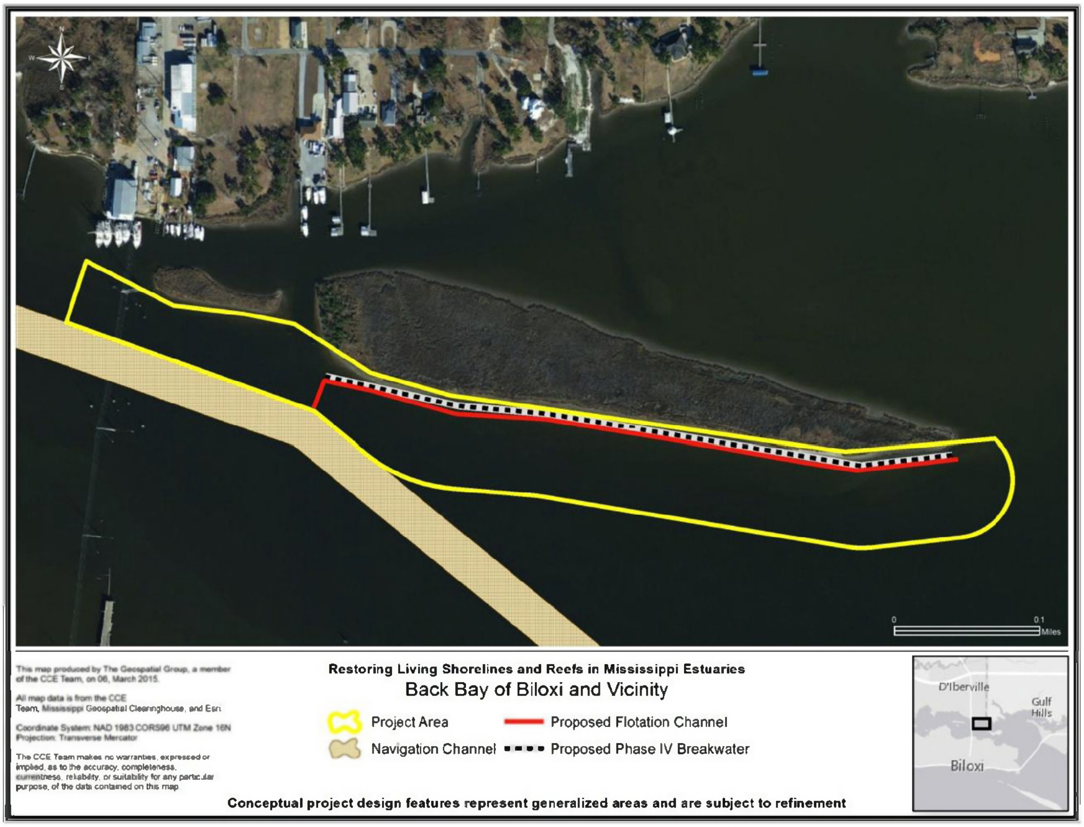

Figure 6: Little Island Living Shoreline Project Area

<u>Deer Island Subtidal Reef (Figure 7)</u>: Would expand an existing Mississippi Department of Marine Resources reef project at Deer Island to create approximately 20 acres of subtidal reef habitat. The conceptual site location for the subtidal reef is depicted in Figure 7 and is subject to refinement.

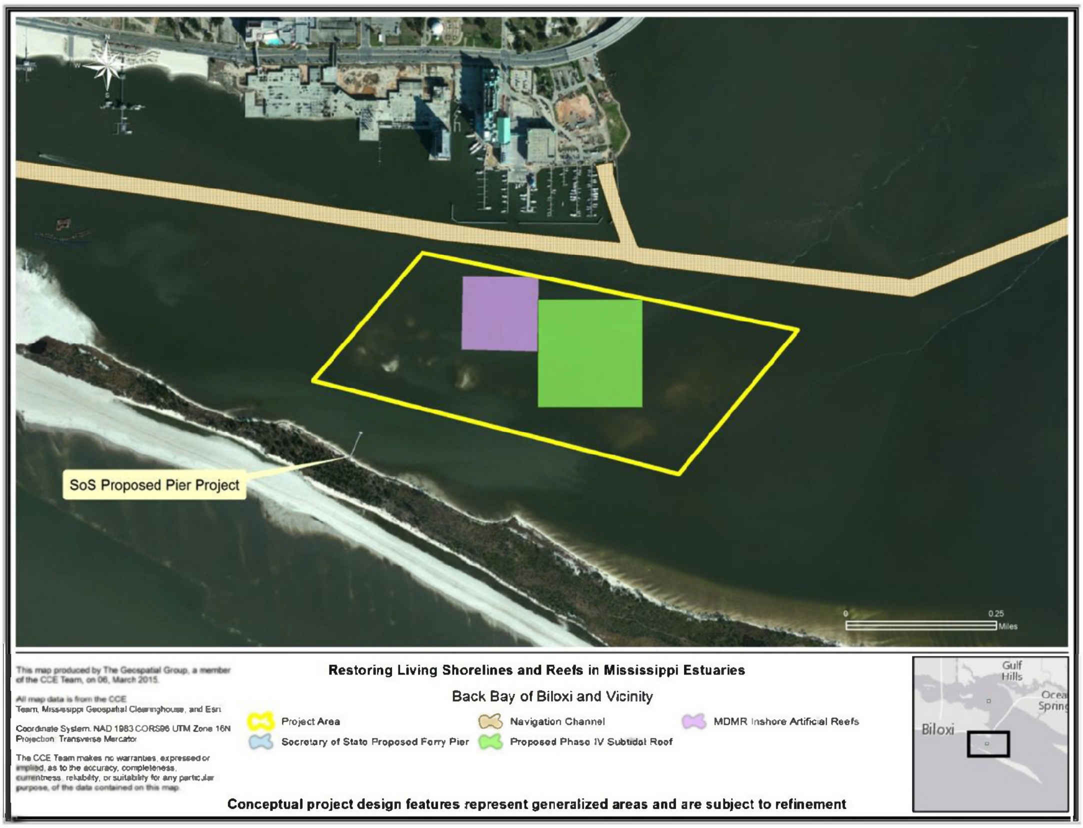

Figure 7: Deer Island Subtidal Reef Project Area

St. Louis Bay Project Components (Harrison and Hancock County)
St. Louis Bay would have two project components including approximately 2.3 miles of breakwater and approximately 30 acres of subtidal reef habitat restoration at two locations.

<u>Wolf River Living Shoreline and Subtidal Reef (Figure 8)</u>: Would include construction of approximately 1,388 ft. of breakwater along the island at the mouth of the Wolf River in St. Louis Bay. This would also include construction of approximately 30 acres of subtidal reef habitat in St. Louis Bay, adjacent to current reef projects at mouth of Wolf River. Conceptual site locations for the breakwater, subtidal reefs and temporary flotation channels are depicted in Figure 8 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

Figure 8: Wolf River Living Shoreline and Subtidal Reef Project Area

<u>St. Louis Bay Living Shoreline (Figure 9)</u>: Would include the construction of approximately 10,812 ft. of breakwater in St. Louis Bay. Conceptual site locations for the breakwater and temporary flotation channels are depicted in Figure 9 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

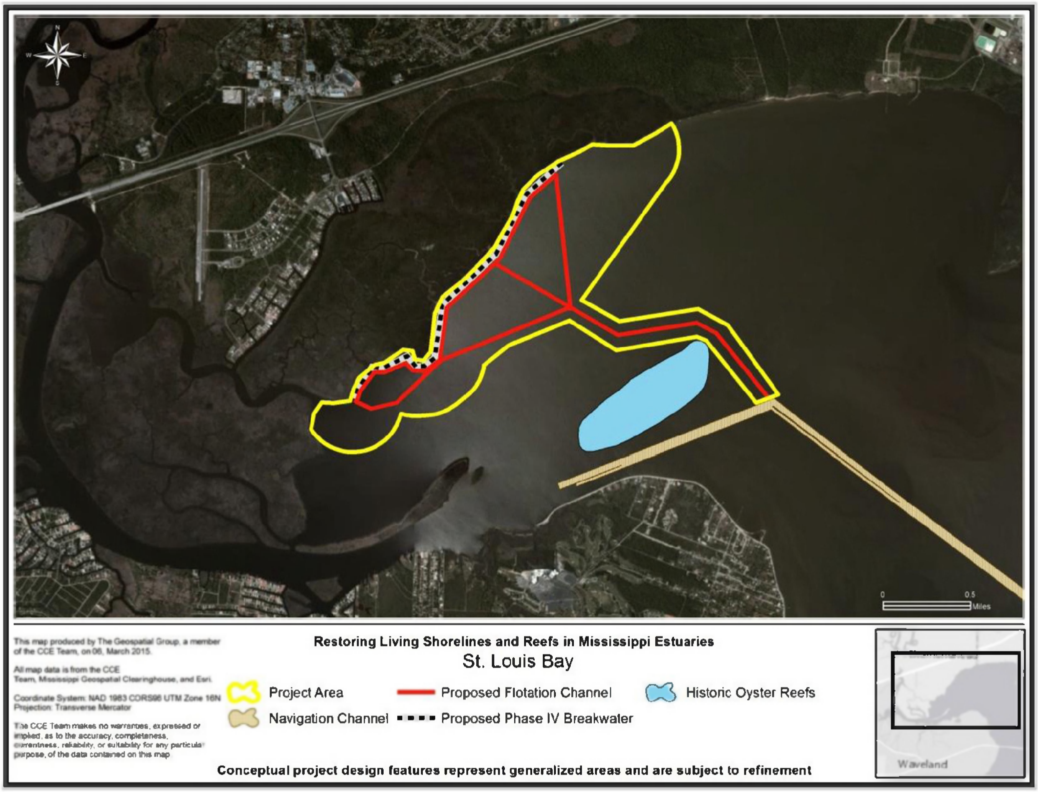

Figure 9: St. Louis Bay Living Shoreline Project Area

Construction and Installation

Construction methods and activities are included to assess the environmental impacts from the proposed project. Actual construction methods and activities would be determined after final design and would be comparable to activities described below.

Breakwaters: The breakwater cross sections selected at each site represent the maximum proposed footprint that would be impacted by placement of the structure (see Table 2). Any adjustments to the proposed cross section during final design would be no greater than the parameters in Table 2. During final design every effort will be made to reduce environmental impacts associated with the project. Construction would take place within the maximum bottom width identified in Table 2. Construction materials would include the placement of linear structures that would utilize approved manufactured and/or natural materials. The alignment and limits of the breakwaters would be sited within the project study area shown in Figures 2 through 9. Navigation signs are anticipated to be required by the USCG Private Aids to Navigation Office. The numbers of navigation signs are estimated in Tables 2 and 4, below. Navigation signs would consist of a 12" treated piling with a plywood or aluminum day board sign and lighted beacon. The piles would be driven by a vibratory hammer from a barge to a depth ranging from 10 – 30 feet below the substrate which would put the day board sign at approximately +10.0 Mean Lower Low Water (MLLW).

The breakwaters would be constructed using approved manufactured and/or natural materials. The materials would be stockpiled at an existing staging area near the project area, which has water access. Mechanical equipment would be utilized to load the materials onto a material handling barge. The materials would be transported to the work area to be deployed by a crane and/or long armed track hoe located on the equipment barge. Placement of the breakwater structure would be monitored to ensure the breakwater dimensions, slopes, and crest elevations are achieved.

Table 2: Restoring Living Shorelines and Reefs in Mississippi Estuaries
Preliminary Design Parameters and Construction Techniques for Breakwater Structures

Project Component		Maximum Structure Width (ft.)	Structure Length (ft.)	Footprint (acres)	Navigation Signs (each)*	Estimated in-water Construction Time (months)
Back Bay of Biloxi	Channel Island Living Shoreline and Subtidal Reef	30	2,385	1.6	0 to 14	8
	Big Island Living Shoreline	30	5,011	3.5	0 to 27	12
	Little Island Living Shoreline	30	2,316	1.6	0 to 14	8
St. Louis Bay	Wolf River Living Shoreline and Subtidal Reef	40	1,388	1.3	0 to 9	6
	St. Louis Bay Living Shoreline	40	10,812	9.9	0 to 56	12
Total			**21,912**	**17.9**	**0 to 120**	**6 – 12**

*Represents preliminary estimate of number of signs; Consultation with the US Coast Guard Private Aids to Navigation Division would be coordinated to determine the required type and spacing of navigation signs.

Subtidal Reef Habitat*:* The subtidal reef habitat would be constructed using approved cultch material (limestone, crushed concrete, oyster shells or a combination thereof). The cultch materials would be stockpiled at an existing staging area, which has water access to the project area. The cultch materials would be inspected at the existing staging area prior to being loaded onto a barge to ensure the materials are clean and free of all debris, including but not limited to, trash, steel reinforcement, and asphalt. Mechanical equipment would be utilized to load the materials onto shallow draft barges or shallow draft self-powered marine vessels. The material would be deployed using a high pressure water jet or using a clam shell bucket mounted on a crane or a long armed track hoe located on a separate equipment barge. The cultch material would be deployed in water depths ranging from 0 to -10 MLLW. The cultch material thickness would be 1 to 12 inches (Table 3).

Intertidal Reef Habitat*:* The Intertidal reef habitat would be constructed using bagged oyster shells. Oyster shells would be bagged and stockpiled at an existing staging area, which has water access to the project area. The bagged oyster shells would be loaded by hand onto shallow draft marine vessels. The shallow draft vessels would transport the bagged oyster shells to the project location where they would be unloaded and placed by hand. The intertidal reef habitat would be constructed along the water's edge between MLLW and Mean Higher High Water (MHHW). Tide surveys would be conducted prior to beginning construction and PVC poles would be placed in the ground to mark the high and low tide elevations (Table 3).

Table 3: Restoring Living Shorelines and Reefs in Mississippi Estuaries
Intertidal and Subtidal Reef Habitats

Project Components		Subtidal Reef Habitat Area (acres)	Intertidal Reef Habitat Area (acres)	Estimated Construction Time (months)
Grand Bay	Grand Bay Intertidal and Subtidal Reefs	77	3	4
Graveline Bay	Graveline Bay Intertidal and Subtidal Reefs	70	2	4
Back Bay Biloxi and Vicinity	Channel Island Living Shoreline and Subtidal Reefs	70	-	4
	Deer Island Subtidal Reef	20	-	2
St. Louis Bay	Wolf River Living Shoreline and Subtidal Reef	30	-	2
Total		**267**	**5**	**2 – 4**

Temporary Flotation Channels*:* The project would be designed to minimize the use of temporary flotation channels to facilitate access for work barges into the project areas. However, if required, due to depth limitations, channels would be excavated parallel to the alignments of the breakwaters. As needed, additional channels would be excavated perpendicular to these channels to allow work barges entry and exit to the project areas. The depth of the channels would be excavated to a maximum of 6 ft. below MLLW to accommodate barge draft. The bottom width of the channels would be approximately 80 ft. with 3H:1V side slopes. The entry locations for the channels would be determined by analyzing the shortest distance from the breakwaters to the appropriate depth of -6 ft MLLW. After installation of the structures is completed the temporary flotation channels would be filled in manually using a clam-shell bucket or long-arm excavator. Best Management Practices (BMPs) would be followed during excavation and backfilling to minimize environmental impacts. For the purposes of project planning, the preliminary temporary flotation channel footprint was calculated based on an estimate of a heavily loaded barge. Proposed temporary flotation channel dimensions are summarized in Table 4. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

Table 4: Restoring Living Shorelines and Reefs in Mississippi Estuaries
Temporary Flotation Channel

Project Components		Channel Length (ft.)	Channel Depth Below MLLW (ft.)	Channel Width (ft.)	Temporarily Impacted Area (acres)	Temporary Navigation Signs (each)
Back Bay of Biloxi	Channel Island Living Shoreline and Subtidal Reef	4,282	6	80	7.9	0 to 29
	Big Island Living Shoreline	5,060	6	80	9.3	0 to 34
	Little Island Living Shoreline	2,450	6	80	4.5	0 to 16
St. Louis Bay	Wolf River Living Shoreline and Subtidal Reef	2,916	6	80	5.4	0 to 19
	St. Louis Bay Living Shoreline	31,766	6	80	58.3	0 to 200
Total					**85.4**	**0 to 298**

Note: Temporary Flotation Channel and Installation of Temporary Navigation Signs included in Estimated Construction Time (Table 2).

Construction Footprint Summary

The maximum construction footprint of the 1) breakwater structures is 17.9 acres; 2) subtidal reefs is 267 acres; 3) intertidal reefs is 5 acres; and 4) flotation channels is 85.4 acres. The total maximum construction footprint of all components, breakwater structures, reefs, and flotation channels is 375.3 acres. Actual construction methods and activities would be determined after final design and would be comparable to activities described above. Any adjustments to the project during final design are anticipated to reduce the environmental impacts associated with the project.

Best Management Practices

Throughout the design process, every practical attempt would be made to avoid and minimize potentially adverse environmental, social, and cultural impacts. The BMPs and conservation measures that would be utilized to minimize impacts to resources are listed in Section 5.3.

Turbidity curtains would not be used during construction activities because the construction is temporary in nature and the construction timeframe is limited and would likely occur at varying times for each project component. Also, the water quality standard establishes that turbidity shall not exceed 50 NTUs of the ambient turbidity outside a 750-foot mixing zone. This activity would likely occur well within this mixing zone and is not expected to disturb the water bottoms to an extent to exceed this standard (Crabtree 2014).

Anticipated pre- and post-construction monitoring activities
Monitoring activities would be performed prior to construction as well as for up to seven years after construction. Monitoring activities would include:

- Topographic/bathymetric surveys
- Biological monitoring
- Marsh edge position
- Water quality

The project would incorporate monitoring efforts to ensure project designs are correctly implemented during construction and to monitor during a subsequent period, where corrective action may be needed as defined by the Trustee. Post-construction performance monitoring would be conducted on the physical condition of the breakwater structures and subtidal and intertidal reefs (e.g. elevation and area, structural integrity, etc.). In those areas where breakwaters are constructed, pre and post-construction monitoring would include shoreline profile/elevation and marsh edge position to detect reduced erosion rates.

Post-construction performance monitoring would also be conducted to evaluate the project's performance over time with respect to the agreed-upon restoration goals and objectives. Specifically, this monitoring would evaluate the production and support of organisms on the breakwater and subtidal and intertidal reefs (e.g., secondary productivity). Monitoring parameters would include the following: water quality (e.g., salinity, dissolved oxygen) and invertebrate infauna and epifauna composition, density, biomass, and secondary productivity.

Anticipated short-term maintenance activities
Maintenance activities for various project components may be include adding approved manufactured and/or natural materials. The breakwater is anticipated to experience the greatest consolidation of the subgrade in the first years following construction. Additional placement of manufactured and/or natural materials on the breakwater would be assessed during the regular monitoring and may be implemented as budget allows. Subtidal and intertidal reefs may require short-term maintenance to ensure proper elevations are maintained to promote secondary productivity (e.g. add more material).

Anticipated long-term maintenance activities
No other operations or maintenance activities are anticipated.

3.0ESSENTIAL FISH HABITAT

The 1996 amendments to the Magnuson-Stevens Act set forth a mandate for NMFS, regional Fishery Management Councils (FMC), and other Federal agencies to identify and protect EFH of economically important marine and estuarine fisheries. To achieve this goal, suitable fishery habitats need to be maintained. EFH in the area of proposed action is identified and described for various life stages of managed fish and shellfish in the northern Gulf (GMFMC 1998). A provision of the Magnuson-Stevens Act requires that FMC's identify and protect EFH for every species managed by a Fishery Management Plan (FMP) (U.S.C. 1853(a)(7)). There are FMP's in the Gulf region for shrimp, red drum, reef fishes, coastal migratory pelagics, and highly migratory species (e.g., sharks). Table 5 presents the EFH within northern Gulf of Mexico, and includes species that may not be present within the area of proposed action.

Table 5. EFH in the Northern Gulf

Management Unit	FMP^*
Red Drum	Red Drum
Highly Migratory Species	
Scalloped Hammerhead Shark	HMS
Bonnethead Shark	HMS
Blacktip Shark	HMS
Bull Shark	HMS
Spinner Shark	HMS
Atlantic Sharpnose Shark	HMS
Shrimp (4 Species)	
Brown shrimp (*Penaeus aztecus*)	
White shrimp (*Penaeus setiferus*)	Shrimp
Pink shrimp (*Penaeus duararum*)	
Royal red shrimp (*Pleoticus robustus*)	
Coastal Migratory Pelagics	
King mackerel (*Scomberomorus cavalla)*	
Spanish mackerel (*Scomberomorus maculatus*)	
Cobia (*Rachycentron canadum*)	Coastal Migratory Pelagics
Dolphin (*Coryphaena hippurus*)	
Little tunny (*Euthynnus alletteratus*)	
Cero mackerel (*Scomberomorus regalis*)	
Bluefish (*Pomatomus saltatrix*)	
Reef Fish (43 Species)	
<u>Balistidae - Triggerfishes</u>	
Gray triggerfish (*Balistes capriscus*)	
<u>Carangidae - Jacks</u>	
Greater amberjack (*Seriola dumerili*)	
Lesser amberjack (*Seriola fasciata*)	
Almaco jack (*Seriola rivoliana*)	
Banded rudderfish (*Seriola zonata*)	
<u>Labridae - Wrasses</u>	
Hogfish (*Lachnolaimus maximus*)	
<u>Lutjanidae - Snappers</u>	Reef Fish
Queen snapper (*Etelis oculatus*)	
Mutton snapper (*Lutjanus analis*)	
Schoolmaster (*Lutjanus apodus*)	
Blackfin snapper (*Lutjanus buccanella*)	
Red snapper (*Lutjanus campechanus*)	
Cubera snapper (*Lutjanus cyanopterus*)	
Gray (mangrove) snapper (*Lutjanus griseus*)	
Dog snapper (*Lutjanus jocu*)	
Mahogany snapper (*Lutjanus mahogoni*)	
Lane snapper (*Lutjanus synagris*)	

Management Unit	FMP^*
Silk snapper (*Lutjanus vivanus*)	
Yellowtail snapper (*Ocyurus chrysurus*)	
Wenchman (*Pristipomoides aquilonaris*)	
Vermilion snapper (*Rhomboplites aurorubens*)	
Malacanthidae – Tilefishes	
Goldface tilefish (*Caulolatilus chrysops*)	
Blackline tilefish (*Caulolatilus cyanops*)	
Anchor tilefish (*Caulolatilus intermedius*)	
Blueline tilefish (*Caulolatilus microps*)	
(Golden) Tilefish (*Lopholatilus chamaeleonticeps*)	
Serranidae – Groupers	
Dwarf sand perch (*Diplectrum bivittatum*)	
Sand perch (*Diplectrum formosum*)	
Rock hind (*Epinephelus adscensionis*)	
Speckled hind (*Epinephelus drummondhayi*)	
Yellowedge grouper (*Epinephelus flavolimbatus*)	
Red hind (*Epinephelus guttatus*)	
Goliath grouper (*Epinephelus itajara*)	
Red grouper (*Epinephelus morio*)	
Misty grouper (*Epinephelus mystacinus*)	
Warsaw grouper (*Epinephelus nigritus*)	
Snowy grouper (*Epinephelus niveatus*)	
Nassau grouper (*Epinephelus striatus*)	
Marbled grouper (*Epinephelus inermis*)	
Black grouper (*Mycteroperca bonaci*)	
Yellowmouth grouper (*Mycteroperca interstitialis*)	
Gag (*Mycteroperca microlepis*)	
Scamp (*Mycteroperca phenax*)	
Yellowfin grouper (*Mycteroperca venenosa*)	

FMP^-Fisheries Management Plan, HMS*- Highly Migratory Species

4.0 MANAGED FISH SPECIES

MANAGED FISH SPECIES

The seasonal and year-round locations of designated EFH for the managed fisheries are depicted on the figures available on the NMFS website (http://sero.nmfs.noaa.gov/hcd/efh.htm) and species abundance maps, both inshore and offshore, are available on the National Ocean Service (NOS) website (http://ccma.nos.noaa.gov/products/biogeography/gom-efh/). EFH figures for HMS are found in the 2009 amendments to the Consolidated Atlantic Highly Migratory Species Fisheries Management Plan. EFH for each managed fishery within the project's footprint is described below:

Red Drum FMP – EFH for red drum consists of all Gulf of Mexico estuaries; waters and substrates extending from Vermilion Bay, Louisiana to the eastern edge of Mobile Bay, Alabama out to depths of 25 fathoms; waters and substrates extending from Crystal River, Florida to Naples, Florida between depths of 5 and 10 fathoms; waters and substrates extending from Cape Sable, Florida to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council between depths of 5 and 10 fathoms.

Shrimp FMP – EFH for shrimp consists of Gulf of Mexico waters and substrates extending from the US/Mexico border to Fort Walton Beach, Florida from estuarine waters out to depths of 100 fathoms; waters and substrates extending from Grand Isle, Louisiana to Pensacola Bay, Florida between depths of 100 and 325 fathoms; waters and substrates extending from Pensacola Bay, Florida to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council out to depths of 35 fathoms, with the exception of waters extending from Crystal River, Florida to Naples, Florida between depths of 10 and 25 fathoms and in Florida Bay between depths of 5 and 10 fathoms.

Coastal Migratory Pelagics FMP – EFH for coastal migratory pelagics consists of Gulf of Mexico waters and substrates extending from the US/Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms. Managed species in this fishery include king mackerel, Spanish mackerel, and cobia. Non-managed species in this fishery include dolphin, little tunny, cero mackerel, and bluefish.

These areas are connected by currents and water patterns that influence the occurrence of HMS at particular times of the year. Due to habitat specific requirements of each species, EFH for each HMS potentially occurring in the vicinity of the project components is described below (EFH information from NMFS, 2009):

<u>Scalloped Hammerhead Shark:</u>

- Neonate/YOY (≤60 cm TL): Coastal areas in the Gulf of Mexico from Texas to the southern west coast of Florida. Atlantic east coast from the mid-east coast of Florida to southern North Carolina.
- Juveniles (61 to 179 cm TL): Coastal areas in the Gulf of Mexico from the southern to mid-coast of Texas, eastern Lousiana to the southern west coast of Florida, and the Florida Keys. Offshore from the mid-coast of Texas to eastern Louisiana. Atlantic east coast of Florida through New Jersey.
- Adults (≥180 cm TL): Coastal areas in the Gulf of Mexico along the southern Texas coast, and eastern Louisiana through the Florida Keys. Offshore from southern Texas to eastern Louisiana. Atlantic east coast of Florida to Long Island, NY.

<u>Bonnethead Shark:</u>

- Neonate/YOY (≤55 cm TL): Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the midcoast of Florida to South Carolina.
- Juveniles (56 to 81 cm TL): Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the midcoast of Florida to South Carolina.
- Adults (≥82 cm TL): Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the mid-coast of Florida to Cape Lookout.

<u>Blacktip Shark:</u>

- Neonate/YOY (≤75 cm TL): Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas from northern Florida through Georgia, and the mid-coast of South Carolina.

- Juvenile (76 to 136 cm TL): Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas localized off of the southeast Florida coast and from West Palm Beach, Florida to Cape Hattaras.
- Adult (≥137 cm TL): Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas southeast Florida to Cape Hattaras.

<u>Bull Shark</u>:
- Neonate/YOY (≤95 cm TL): Gulf of Mexico coastal areas along Texas, and localized areas off of Mississippi, the Florida Panhandle, and west coast of Florida; as well as the Atlantic mid-east coast of Florida.
- Juveniles (96 to 219 cm TL): Gulf of Mexico coastal areas along the Texas coast, eastern Louisiana to the Florida Panhandle, and the west coast of Florida through the Florida Keys. Atlantic coastal areas localized from the mid-east coast of Florida to South Carolina.
- Adults (≥220 cm TL): Gulf of Mexico along the southern and mid-coast of Texas to western Louisiana, eastern Louisiana to the Florida Keys. East coast of Florida to South Carolina in the Atlantic.

<u>Spinner Shark:</u>
- Neonate/YOY (≤70 cm TL): Localized coastal areas in the Gulf of Mexico along Texas, eastern Louisiana, the Florida Panhandle, Florida west coast, and the Florida Keys; and in the Atlantic along the east coast of Florida to southern North Carolina.
- Juveniles (71 to 179 cm TL): Gulf of Mexico coastal areas from Texas to the Florida Panhandle, and the mid-west coast of Florida to the Florida Keys. Atlantic east coast of Florida through North Carolina.
- Adults (≥180 cm TL): Localized areas in the Gulf of Mexico off of southern Texas, Louisiana through the Florida Panhandle, and from the mid-coast of Florida through the Florida Keys. In the Atlantic along the east coast of Florida, and localized areas from South Carolina to Virginia.

<u>Atlantic Sharpnose Shark</u>
- Neonate/YOY (≤60 cm TL): Gulf of Mexico coastal areas from Texas through the Florida Keys. In the Atlantic from the mid-coast of Florida to Cape Hattaras.
- Juveniles (61 to 71 cm TL): Gulf of Mexico coastal areas from Texas through the Florida Keys. In the Atlantic from the mid-coast of Florida to Cape Hattaras, and a localized area off of Delaware.
- Adults (≥72 cm TL): Gulf of Mexico from Texas through the Florida Keys out to a depth of 200 meters. In the Atlantic from the mid-coast of Florida to Maryland.

Reef Fish FMP – EFH for reef fish consists of Gulf of Mexico waters and substrates extending from the US/Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.

4.1 ECOLOGICAL NOTES ON THE EFH FISHERIES AND SPECIES

<u>Habitats at the Proposed Project Components</u>

The project components of proposed action are composed largely of estuarine shallow water and shallow open water. The benthic habitats can be divided into two classes - intertidal and subtidal.

Intertidal zones (typical tidal range of 0.5 ft.) near the project components are generally composed of mud flats and small areas of natural sand beach. In general, the nearshore subtidal benthic habitat is composed mostly of unconsolidated bottom types including sand, muddy sand, and mud bottom. The subtidal reefs would be installed in a water depth between Mean Lower Low Water (MLLW) and -10.0 ft. MLLW where SAV is not present. Submerged aquatic vegetation (SAV) is present in large beds in Grand Bay. SAV surveys have been completed by staff at the Grand Bay National Estuarine Research Reserve (GBNERR) Benthic habitat and SAVs support an array of neonate, juvenile, and adult fish. Intertidal and subtidal oyster deployments would be sited to avoid SAVs. Breakwaters would avoid impact SAVs to the extent practicable and are generally sited adjacent to eroding shorelines where SAVs are typically not found.

The following section describes the EFH within the area of proposed action. Table 6 lists the EFH species that utilize the area of proposed action.

Table 6: EFH within the Area of Proposed Action

GoM FMP Group	Species	Habitat Type	Eggs	Larvae	Post Larvae	Early Juveniles	Late Juveniles	Adults	Spawning Adults
Red Drum Fishery	Red Drum (*Sciaenops ocellatus*)	SAV, soft bottom, hard bottom, sand/shell, emergent marsh		growth; feeding	growth; feeding	growth; feeding	growth; feeding	feeding	feeding
Reef Fish Fishery	Mutton Snapper (*Lutjanus analis*)	SAV				growth; feeding	growth; feeding	feeding	
	Cubera Snapper (*Lutjanues cyanopterus*)	SAV, emergent marsh				growth	growth		
	Gray Snapper (*Lutjanus griseus*)	SAV, soft bottom, sand/shell, emergent marsh			growth; feeding	growth; feeding	growth; feeding	feeding	
	Lane Snapper (*Lutjanus synagris*)	SAV, soft bottom, sand/shell			growth	growth; feeding	growth; feeding		
	Yellowtail Snapper (*Ocyurus chrysurus*)	SAV, soft bottom				growth; feeding			
	Goliath Grouper (*Epinephelus itajara*)	SAV, hard bottom				growth; feeding	growth; feeding		
	Red Grouper (*Epinephelus morio*)	SAV, hard bottom				growth; feeding	growth; feeding		
	Black Grouper (*Mycteroperca bonaci*)	SAV				growth; feeding			
Coastal Pelagic Fishery	Spanish Mackerel (*Scomberomoru s maculatus*)	pelagic				growth; feeding	growth; feeding	growth; feeding	
Shrimp Fishery	Brown Shrimp (*Penaeus aztecus*)	SAV, soft bottom, sand/shell, emergent marsh, oyster			growth; feeding	growth; feeding	growth; feeding		

		reef							
	White Shrimp (*Penaeus setiferus*	emergent marsh, soft bottom			growth; feeding	growth; feeding	growth; feeding		

4.1.1 Red Drum

In the Gulf, red drum occur in a variety of habitats, ranging from depths of about 130 feet offshore to very shallow estuarine waters. Red drum utilize SAV, soft bottom, sand/shell, and emergent marsh habitat during all life cycle stages (Table 6). They commonly occur in all of the Gulf's estuaries where they are associated with a variety of substrate types including sand, mud, and hardened bottom. Throughout the Gulf, red drum use seagrass meadows as nursery and foraging habitat (GMMFC 2004). Estuaries provide habitat for red drum and species that it preys on. The GMFMC considers all estuaries to be EFH for the red drum. Schools of large red drum are common in the deep Gulf waters with spawning occurring in deeper water near the mouths of bays and inlets, and on the Gulf side of the barrier islands.

In general, for all of the project components the red drum fishery is very common. The estuarine zone is used by this species in all life stages. Habitat use is highest for nearshore hard bottoms, nearshore sand/shell, estuarine SAV, and estuarine soft bottoms (GMFMC 2005). Larvae, juveniles, and young adults spend the majority of their time in estuarine habitats and prey on a large array of species including blue crab eggs and numerous juvenile fish.

4.1.2 Reef Fish

The reef fish FMP in the area of proposed action include snappers and groupers. Reef fish utilize a variety of habitats including SAV, soft bottom, hard bottom, sand/shell, and emergent march during their juvenile and adult life cycle stages (Table 6). They are often found as adults associated with coral reef, limestone, hard bottom, and artificial reef substrates. Occasionally adults occur over sand, away from reefs, but these appear to be foraging individuals. There is some evidence that adults have restricted movement and do not display long migrations. Juveniles of many of the reef fish species are located in shallow, inshore areas associated especially with SAV beds and inshore reefs. There is a general tendency for older and larger fish to occur in deeper water extending to the edge of the continental shelf. Reef fish feed on a variety of invertebrates including shrimp, craps, amphipods, octopus, and squid. Larger reef fish also have a tendency to eat small fish and other larger food items (GMFMC 1981).

Reef fish utilize both pelagic and benthic habitats during their life cycle. A planktonic larval stage lives in the water column and feeds on zooplankton and phytoplankton. Juvenile and adult reef fish are typically demersal and usually associated with bottom topographies on the continental shelf that have high relief: i.e., coral reefs, artificial reefs, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings. More detail on these habitat types is found in the Fishery Management Plan (FMP) for Corals and Coral Reefs (GMFMC and SAFMC 1983). However, several species are found over sand and soft-bottom substrates. Some juvenile snapper and grouper such as mutton, gray, lane, and yellowtail snappers and red grouper have been documented in inshore seagrass beds, mangrove estuaries, lagoons, and larger bay systems (GMFMC 1981).

For all of the proposed action project component areas, the reef fish fishery includes numerous species that utilize the estuarine zone in certain life stages. Most are transitory species and use inshore environments part of the year. Only mutton (*Lutjanus analis*) and gray snapper (*Lutjanus griseus*) use the estuarine zone as adults for feeding. Reef species have the potential to use this zone as early or late juveniles for growth and feeding habitat.

4.1.3 Coastal Migratory Pelagics

The managed coastal migratory pelagics in the area of proposed action include Spanish mackerel. Spanish mackerel is jointly managed by the GMFMC and the South Atlantic Fisheries Management Council. Spanish mackerel migrate south during the winter months and return north in the spring to their spawning grounds (GMFMC & SAFMC, 1983). Mackerel are opportunistic carnivores and tend to feed on other smaller fishes.

In the area of project components, only the Spanish mackerel (*Scomberomorus maculatus*) uses the estuarine zone during the early and late juvenile and adult life stages (Table 6).

4.1.4 Shrimp

Shrimp use a variety of estuarine and marine habitats in the Gulf of Mexico. Brown shrimp are found within the estuaries to offshore depths of 110 meters (m) throughout the Gulf; white shrimp inhabit estuaries and to depths of about 40 m offshore in the coastal area extending from Florida's Big Bend area through Texas. Brown and white shrimp are generally more abundant in the central and western Gulf.

Brown Shrimp

Brown shrimp range in the Gulf of Mexico from Florida to the northwestern coast of Yucatan. The range is not continuous but is marked by an apparent absence of brown shrimp along Florida's west coast between the Sanibel and the Apalachicola shrimping grounds. In the U.S. Gulf of Mexico, catches are high along the Texas, Louisiana, and Mississippi coasts. Shrimp are typically found as post larvae and juveniles in shallow vegetated habitats (including SAV, soft bottom, sand/shell, emergent marsh, and oyster reef habitat), and occasionally, in silty sand and non-vegetated bottoms (Table 6). Juveniles and sub-adults generally prefer shallow estuaries and marsh edges (plant-water interfaces). Sub-adults migrate from estuaries during outgoing high tides. Adult brown shrimp typically inhabit Gulf waters from the Mean Low Water line to the continental shelf (GMFMC, 2006). Post-larvae, early juvenile, and late-juvenile brown shrimp use estuarine habitat for survival. Emergent marsh and marsh edge are particularly important microhabitats for these species, and they would use the tidal cycle to enter low emergent marsh adjacent to the shoreline (GMFMC 2004).

White Shrimp

White shrimp are offshore and estuarine dwellers, and are pelagic or demersal depending on their life stage. The eggs are demersal and larval stages are planktonic, and both occur in nearshore marine eaters. Post larval white shrimp become benthic upon reaching the nursery areas of estuaries, seeking shallow water with muddy-sand bottoms that are high in organic detritus. Juveniles move from estuarine areas to coastal waters as they mature. Adult white shrimp are demersal and generally inhabit nearshore Gulf waters in depths less than 100 feet on soft mud or silty bottoms (GMFMC, 2006). Post-larvae, early juvenile, and late-juvenile white shrimp use estuarine habitat (emergent marsh and soft bottom habitat) for survival (Table 6). Emergent marsh and marsh edge are particularly important microhabitats for these species, and they would use the tidal cycle to enter low emergent marsh adjacent to the shoreline (GMFMC 2004).

4.1.5 Highly Migratory Species

Estuarine waters like those found in the proposed action area provide EFH resources for various life stages of HMS. Sharks enter the shallow estuarine bay waters to forage and feed. The shark species discussed in this assessment generally feed on a variety of small fish (such as menhaden, seatrout, croaker, and perch), shrimp, small sharks, crabs, and seagrass (most likely a result of foraging behavior) (Adams and Paperno, 2007; Bethea et. al., 2009).

5.0 ASSESSMENT OF IMPACTS AND MITIGATIVE MEASURES

The Trustee, in consultation with the contractors, would take all practicable precautions to minimize unavoidable negative impacts to EFH. The project would not result in long-term adverse, direct impacts to emergent wetlands, existing oyster reefs, or Submerged Aquatic Vegetation (SAV). Most motile fauna such as crab, shrimp, and finfish would likely avoid the area of proposed action during the construction process. Following construction, there is expected to be increased habitat utilization of the breakwaters and near-shore environment by these species and a beneficial, long-term impact is anticipated. The project may result in minor, adverse short-term impacts to benthic organisms and temporarily affect habitat utilization by individuals considered under EFH fishery management plans. The potential impacts and minimization/mitigative measure are discussed in greater detail below (Section 5.3).

5.1 IMPACTS TO EFH

Minor and temporally limited impacts to EFH components are expected to soft bottom substrates, since the Restoring Living Shorelines and Reefs in Mississippi Estuaries project would be constructed in an areas that are considered EFH for various lifestages of the species managed under FMPs. Because of SAV's overall significance to nearly all managed fisheries, a brief description of effects is provided here. Breakwaters would be sited to avoid SAVs to the extent practicable. Therefore these construction activities would have no long-term, adverse impact on SAVs. The impacts would be localized per project component. There would be long term, minor impacts to 289.9 acres of soft bottom habitat due to the construction of breakwaters (17.9 acres), subtidal reefs (267 acres) and intertidal reefs (5 acres); Table 7. There would be short term, minor impacts to 85.4 acres of soft bottom habitat for the construction of flotation channels, if needed for construction of breakwaters, subtidal and intertidal reef habitat (Table 7).

Table 7. Restoring Living Shorelines and Reefs in Mississippi Estuaries-Project Component Impacts

Project Components	Breakwater Structure Area Max. (acres)	Subtidal Reef Habitat (acres)	Intertidal Reef Habitat (acres)	Temporary Flotation Channels (acres)
Grand Bay and Graveline Bayou (Jackson County)				
Grand Bay Intertidal and Subtidal Reefs		77	3	-
Graveline Bay Intertidal and Subtidal Reefs		70	2	-
Back Bay of Biloxi and Vicinity (Jackson and Harrison County)				
Channel Island Living Shoreline and Subtidal Reefs	1.6	70	-	7.9
Big Island Living Shoreline	3.5	-	-	9.3
Little Island Living Shoreline	1.6	-	-	4.5
Deer Island Subtidal Reef	-	20	-	-
St. Louis Bay (Harrison and Hancock County)				
Wolf River Living Shoreline and Subtidal Reef	1.3	30	-	5.4
St. Louis Bay Living Shoreline	9.9	-	-	58.3
TOTAL	17.9 acres	267 acres	5 acres	85.4 acres

Description of Activities for Project Components

The following is a description of project components in 8 locations in four bays in the Jackson, Harrison and Hancock Counties. Figures 1-9 are depictions of project areas and respective components. The siting of breakwaters, intertidal and subtidal reefs for the Restoring Living Shorelines and Reefs in Mississippi Estuaries project components are conceptual and subject to refinement. For the purposes of impact analysis, the Trustees have conservatively estimated the maximum footprint for permanent and temporary impacts resulting from the deployment of breakwaters, subtidal reefs, and intertidal reefs, as well as the excavation of temporary construction channels. Additionally, an estimated project area in which the total impacts would occur is also provided. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum temporary impacts, but these impacts may be avoided depending on final project design, construction techniques and/or construction timing. To the extent practicable, submerged aquatic vegetation (SAVs) would be avoided; however, none is expected to be impacted at this time. To the extent practicable, subtidal habitat would be sited in locations where there is existing or adjacent historic hard bottom habit. Intertidal oyster surveys inventories would be completed as part of siting intertidal habitat. Other reasons for refinement in project location include but are not limited to:

- Avoidance of natural or cultural resources (e.g. oysters, SAVs or archaeological sites);
- Revised siting based on natural resource inventory (e.g. locating subtidal reefs on or near existing or historic hard bottom habitat);
- Engineering considerations including but not limited to geotechnical, hydrological, navigation, construction materials, construction techniques or bathymetric design constraints;
  Input received during the public comment period;
- Input received during the public comment period.

Grand Bay Project Component (Jackson County)

Grand Bay Intertidal and Subtidal Reefs: A total of approximately 80 acres of hard and soft bottom habitat would be impacted and would be replaced with hard structure (Figure 2). SAVs are present at Grand Bay. Project component structures would not be installed in any SAV beds to the extent practicable. Data from Grand Bay National Estuarine Research Reserve (GBNERR) SAV surveys has been used in the planning process to site the structures outside of any known SAV beds. Further coordination with the staff of GBNERR for the final location of project components would occur to avoid SAVs. The construction of subtidal and intertidal reefs at Grand Bay would be not require flotation channels.

Subtidal Habitat: Approximately 77 acres consisting of unconsolidated soft and hard bottom (sand, muddy sand, mud bottom, and remnant reef/hard bottom), would be permanently impacted by the deployment of cultch to restore subtidal reef habitat. To the extent practicable, subtidal habitat would be sited in locations where there is existing or historic hard bottom habitat.

Intertidal Habitat: Approximately 3 acres of intertidal soft bottom habitat and mud flats would be impacted by the placement of loose oyster shells or bagged oyster shells to create intertidal reef habitat. To the extent practicable, intertidal reef would be sited where there is existing or historic intertidal reef habitat.

Graveline Bay Project Component (Jackson County)

Graveline Bay Intertidal and Subtidal Reefs: A total of approximately 72 acres of hard and soft bottom habitat would be impacted and will be replaced with hard structures (Figure 3). SAVs are not anticipated to be present in the project component area. If warranted, SAV surveys would be completed prior to construction activities to avoid impacts to SAVs. SAVs would be avoided to the extent practicable.

Subtidal Habitat: Approximately 70 acres of subtidal habitat, consisting of unconsolidated soft and hard bottom (sand, muddy sand, mud bottom and remnant reef/hard bottom) would be permanently impacted by the deployment of cultch to restore subtidal reef habitat. To the extent practicable, subtidal habitat would be sited in locations where there is existing or historic hard bottom habitat.

Intertidal Habitat: Approximately 2 acres of intertidal habitat soft bottom habitat, mud flats would be impacted by the placement of loose oyster shells or bagged oyster shells to restore intertidal reef habitat. To the extent practicable, intertidal reef would be sited where there is existing or historic intertidal reef habitat.

Back Bay of Biloxi and Vicinity Project Components (Jackson and Harrison Counties)
Back Bay of Biloxi includes four project components; approximately 118.4 acres of hard and soft bottom habitat would be impacted by the construction of breakwaters, subtidal reefs and temporary flotation channels. SAVs are not anticipated to be present in the project component area. If warranted, SAV surveys would be completed prior to final site selection of structures to avoid impacting SAVs. SAVs would be avoided to the extent practicable.

<u>Channel Island Living Shoreline and Subtidal Reef</u>: A total of approximately 79.5 acres of soft and hard bottom habitat would be impacted, of which 71.6 acres and will would be replaced with hard structures; approximately 7.9 acres of flotation channels could be required (Figure 4).

Breakwater Structure: Approximately 2,385 linear ft. of breakwater would be constructed with approved manufactured and/or natural materials. Construction of the breakwater would permanently impact approximately 1.6 acres of mostly unconsolidated soft bottom (sand, muddy sand, and mud bottom). Temporary flotation channels may be required for the construction of breakwaters and are depicted in Figure 4. Estimated channel lengths are 4,282 linear ft. for a total of 7.9 acres. Temporary flotation channels would be backfilled mechanically after construction is complete.

Subtidal habitat: Approximately 70 acres of mostly unconsolidated soft and hard bottom (sand, muddy sand, mud bottom, and remnant reef/hard bottom) would be permanently impacted by the deployment of cultch to restore subtidal habitat. To the extent practicable, subtidal habitat would be sited in locations where there is existing or historic hard bottom habitat.

<u>Big Island Living Shoreline</u>: Approximately 5,011 linear ft. of breakwater would be constructed with approved manufactured and/or natural materials. Construction of the breakwater would permanently impact approximately 3.5 acres of soft bottom habitat (sand, muddy sand, and mud bottom). Temporary flotation channels may be required for the construction of breakwaters and are depicted in Figure 5. Estimated channel lengths are 5,060 linear ft. for a total of 9.3 acres (Table 4). Temporary flotation channels would be backfilled mechanically after construction is complete.

<u>Little Island Living Shoreline</u>: Approximately 2,316 linear ft. of breakwater would be constructed with approved manufactured and/or natural materials. Construction of the breakwater would permanently impact approximately 1.6 acres of soft bottom habitat (sand, muddy sand, and mud bottom). Temporary flotation channels may be required for the construction of breakwaters and are depicted in Figure 6. Estimated channel lengths are 2,450 linear ft. for a total of 4.5 acres (Table 4). Temporary flotation channels would be backfilled mechanically after construction is complete.

Deer Island Subtidal Reef: Approximately 20 acres of mostly unconsolidated soft and hard bottom (sand, muddy sand, mud bottom, and remnant reef/hard bottom) would be permanently impacted by the deployment of cultch to restore subtidal habitat. To the extent practicable, subtidal habitat would be sited in locations where there is existing or historic hard bottom habitat.

St. Louis Bay Project Components (Harrison and Hancock Counties)
St. Louis Bay includes two project components; approximately 104.9 acres of soft and hard bottom habitat would be impacted including breakwaters, subtidal reefs and temporary flotation channels. SAVs are not anticipated to be present in the project component area. If warranted, SAV surveys would be completed prior to final site selection of structures to avoid impacting SAVs. SAVs would be avoided to the extent practicable.

Wolf River Living Shoreline and Subtidal Reef: A total of approximately 36.7 acres of soft and hard bottom habitat would be impacted, of which 31.3 acres and will would be replaced with hard structures; approximately 5.4 acres of temporary flotation channels could be required (Figure 8).

Breakwater Structure: Approximately 1,388 linear ft. of breakwater would be constructed with approved manufactured and/or natural materials. Construction of the breakwater would permanently impact approximately 1.3 acres of mostly unconsolidated soft bottom (sand, muddy sand, and mud bottom). Temporary flotations channels may be required for the construction of breakwaters and are depicted in Figure 8. Estimated channel lengths are 2,916 linear ft. for a total of 5.4 acres. Temporary flotation channels would be backfilled mechanically after construction is complete.

Subtidal habitat: Approximately 30 acres of mostly unconsolidated soft and hard bottom (sand, muddy sand, mud bottom, and remnant reef/hard bottom) would be permanently impacted by the deployment of cultch to restore subtidal habitat. To the extent practicable, subtidal habitat would be sited in locations where there is existing or historic hard bottom habitat.

St. Louis Bay Living Shoreline: Approximately 10,812 linear ft. of breakwater would be constructed with approved manufactured and/or natural materials. Construction of the breakwater would permanently impact approximately 9.9 acres of soft bottom habitat (sand, muddy sand, and mud bottom). Temporary flotation channels may be required for the construction of breakwaters and are depicted in Figure 9. Estimated channel lengths are 31,766 linear ft. for a total of 58.3 acres (Table 4). Temporary flotation channels would be backfilled mechanically after construction is complete.

5.2 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

Environmental consequences of the proposed action include a discussion of the direct, indirect and cumulative impacts in the section below.

Direct Impacts
During construction of the breakwaters and reefs, the fine-grained soft bottom habitat would be altered by the placement of materials. The footprint of the project is approximately 375.3 acres (Table 8). Approximately 17.9 acres would be filled for breakwater construction, 267 acres for subtidal reef, and 5 acres for intertidal oyster reef creation, resulting in a long-term, minimal impact. Approximately 85.4 acres would be excavated for flotation channels resulting in a short-term impact.

Table 8. Summary of Proposed Action			
Project Activity	**Acreage Impacted**	**Habitat**	**Nature of Impact Improvement**
Living Shorelines (Breakwater)	4.1 miles (17.9acres)	Intertidal sediments off marsh edge; -3 to 6 ft. contour.	Covering sediments with breakwater; establishment of a high relief living reef
Subtidal Reef Habitat	267 acres	0 -10 ft. MLLW; existing or historic hard bottom/reef habitat; unconsolidated bottom types including sand, muddy sand, and mud bottom;	Cultch deployment of 267 acres of subtidal reef habitat
Intertidal Reef Habitat	5 acres	0 to 3 ft. MLLW; mud flats and soft bottom; existing or historic intertidal reef habitat	Cultch deployment of 3 acres of intertidal reef habitat
Flotation Channels	85.4	Soft sediment	Dredge and side cast a 44,635 ft. of channel 80 ft. wide and 6 ft. below MLLW.
Total	375.3 acres		

There would be minor, long term, adverse impacts to EFH for species that rely on soft bottom habitat as a result of the project. Minor, long term, adverse impacts to EFH for various life stages of yellowtail snapper and white shrimp are listed in Table 9.

There would be short term, minor, impacts to EFH for species that utilize both soft and hard bottom habitat. Short term, minor, impacts to EFH for various life stages of red drum, gray snapper, lane snapper, Spanish mackerel, and brown shrimp are listed in Table 9.

SAV beds will be avoided to the extent practicable. Table 9 includes EFH for SAV dependent and pelagic species which would not be affected by the project.

Breakwaters, intertidal reefs and subtidal reefs are expected to develop into living reefs that support benthic secondary productivity, including, but not limited to, bivalve mollusks, annelid worms, shrimp, and crabs and would protect salt marsh habitat. Table 9 includes EFH for various life stages of fishes which benefit from the utilization of hard bottom and marsh including, red drum, cubera snapper, gray snapper, goliath grouper, red grouper, brown shrimp, and white shrimp.

Bottom Disturbance and Turbidity
Deployment of the breakwaters, intertidal reef habitat, subtidal reef habitat, and temporary flotation channels would result in short-term, minor adverse impacts to water quality as a result of re-suspension of sediment by vessels (barges, tugs, skiffs, etc.) moving in and out of the area of proposed action. The suspended sediment may be transported into surrounding wetlands, waterways, and the Mississippi Sound. However, the area is currently exposed to elevated turbidity levels as a result of natural re-suspension of sediment during frequent storms, tides and other typical events.

Disturbance of the bottom sediment by placing hardened structure may temporarily affect prey availability in the area of proposed action for juvenile and adult fish. The adverse impacts from placing material would be short-term, localized and minor, affecting individuals and not entire populations. Since potential impacts would be localized and short term, there are no expected impacts to populations since spawning, feeding, and resting occurs over broad areas.

Best management practices along with other avoidance and mitigation measures required by state and federal regulatory agencies would be employed to minimize potential water quality and sedimentation impacts. U.S. Army Corps of Engineers Section 10/404 and State Water Quality Certifications would be required; all project activities would be conducted in compliance with permit conditions. Impacts from turbidity would be moderate, short-term and limited in spatial extent.

Natural Shell Sourcing

Adverse impacts may result depending on the source from which shell for the reef is obtained. Shells are commonly acquired via two methods. Dredge shell programs obtain buried shells by dredging areas, which can cause short-term turbidity problems. In addition, any aquatic organisms in the area would be eliminated. The other method of obtaining shell is to purchase them through commercial seafood processors or shucking houses. This method has no adverse impacts to the aquatic environment. In addition, shell should, where practicable, should be obtained from commercial sources where no impacts to habitat were made during shell acquisition. There are several commercial sources of cultch material and shell, and no one source has been specified for use.

Table 9: Restoring Living Shorelines and Reefs in Mississippi Estuaries-EFH Impact Summary

Species	Habitats Utilized	Life stages within the Area of Proposed Action	Grand Bay Project Components (80 acres)	Graveline Bay Project Components (72 acres)	Back Bay of Biloxi Project Components (96.7 acres permanent; 21.7 acres for temporary flotation channels)		St. Louis Bay Project Components (41.2 acres permanent; 63.7 acres for temporary flotation channels)	
					Breakwater	Reef	Breakwater	Reef
Red Drum (*Scianops ocellatus*)	SAV, soft bottom, hard bottom, sand/shell, emergent marsh	Larvae, post larvae, juvenile, adult, spawning adults	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor
Mutton Snapper (*Lutjanus analis*)	SAV	Juvenile, adult						
Cubera Snapper (*Lutjanues cyanopterus*)	SAV, emergent marsh	juvenile						
Gray Snapper (*Lutjanus griseus*)	SAV, soft bottom, sand/shell, emergent marsh	Post larvae, juvenile, adult,	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor
Lane Snapper (*Lutjanus synagris*)	SAV, soft bottom, sand/shell	Post larvae, juvenile	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short g term, minor
Yellowtail Snapper (*Ocyurus chrysurus*)	SAV, soft bottom	juvenile	Long term, minor	Long term, minor	Long term, minor	Long term, minor	Long term, minor	Long term, minor
Goliath Grouper (*Epinephelus itajara*)	SAV, hard bottom	juvenile						
Red Grouper (*Epinephelus morio*)	SAV, hard bottom	juvenile						

Black Grouper (*Mycteroperca bonaci*)	SAV	juvenile						
Spanish Mackerel (*Scomberomorus maculatus*)	pelagic	Juvenile, adult	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor
Brown Shrimp (*Penaeus aztecus*)	SAV, soft bottom, sand/shell, emergent marsh, oyster reef	Post larvae, juvenile	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor
White Shrimp (*Penaeus setiferus*	emergent marsh, soft bottom	Post larvae, juvenile	Long term, minor	Long term, minor	Long term, minor	Long term, minor	Long term, minor	Long term, minor

Indirect

Indirect adverse impacts are not expected in the short or long term. Long-term indirect benefits are expected to EFH resources in close proximity to the project components due to anticipated increases in use of this area by transient adult and juvenile fish as foraging grounds.

Cumulative

Within the action area, major future changes are not anticipated at the project site and recreational use of the area is expected to continue at present levels in the near future. Listed species of sea turtle and Gulf sturgeon may be affected, but are not likely to be adversely affected during their life cycles from project activities. The "Restoring Living Shorelines and Reefs in Mississippi Estuaries" project would have a beneficial effect on the estuarine habitats in the area soon after construction. Breakwaters, intertidal reefs and subtidal reefs are expected to develop into living reefs that support benthic secondary productivity, including, but not limited to, bivalve mollusks, annelid worms, shrimp, and crabs and would protect salt marsh habitat over a 3 to 5 year timeframe. The cumulative impact of these structures and the anticipated reduce the wave energy and erosion landward of the breakwaters. Restoration efforts would result in conditions favorable to reef colonization and to generally improve water quality. Increasing structural habitat and reduced shoreline erosion would improve EFH in the area.

5.3 PROPOSED MITIGATIVE MEASURES AND GUIDELINES FOR EFH PROTECTION

1. Use of Best Management Practices (BMP)

Best management practices (BMPs) are measures to minimize and avoid all potential adverse impacts to EFH during Restoring Living Shorelines and Reefs in Mississippi Estuaries project construction and monitoring. This conservation measure recommends the use of BMPs during construction to reduce impacts from project implementation. BMPs shall include but are not limited to:

a. Work barges would be moored for overnight and weekends/holidays in areas where previous impacts have occurred.
b. After installation of the structures is completed, the flotation channels would be filled in manually using a clam-shell bucket or long-arm excavator.
c. All construction activities would be completed during daylight hours.

2. Drive Pilings Instead of Jetting Pilings

Pilings would be driven instead of jetting to reduce the disturbance of bottom sediments and bottom dwelling organisms.

3. Obtain Shell from Commercial Vendors Instead of From Dredged Sites
Where practicable, shell would be obtained from commercial vendors that did not or will not impact the aquatic environments. This shell would be utilized for reef construction. There are several commercial sources of cultch material and shell, and no one source has been specified for use.

4. Monitor Structures & Adaptively Manage Structures
Monitoring would be conducted before, during, and after project implementation to ensure compliance with project design and completion. If immediate post-construction monitoring reveals that unavoidable impacts to EFH have occurred, appropriate coordination with regional EFH personnel would take place to determine appropriate response measures, possibly including mitigation. If additional adaptive management of the breakwater structure is necessary after monitoring events, all minimization measures discussed above would be followed.

5. Post-Project Implementation Removal
Monitoring would assess whether unexpected impacts to EFH have occurred.

6. Protected Species
For projects located in Gulf sturgeon critical habitat (Grand Bay Intertidal and Subtidal Reefs and Deer Island Subtidal Reef), to the extent practicable, project construction would be limited to the window between May and October, after sturgeon have migrated to their riverine habitat. If work continues beyond the May to October window, continued adherence to the Sea turtle and Smalltooth Sawfish Construction Conditions (NMFS, 2006) would minimize the potential for impacting Gulf Sturgeon.

Sea turtle and Smalltooth Sawfish Construction Conditions (NMFS, 2006) would be adhered to for all of the Restoring Living Shorelines and Reefs in Mississippi project components.

6.0 CONCLUSIONS

Overall, there would not be substantial adverse impact to EFH. The potential adverse impacts related to the Restoring Living Shorelines and Reefs in Mississippi Estuaries project construction would be minor, short term and minor long term. The potential long-term benefits to EFH, especially for shrimp, red drum, and juvenile coastal pelagics and reef fish include increased foraging habitat, increased cover for juveniles, and improved water quality.

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